

Astrobee System Overview

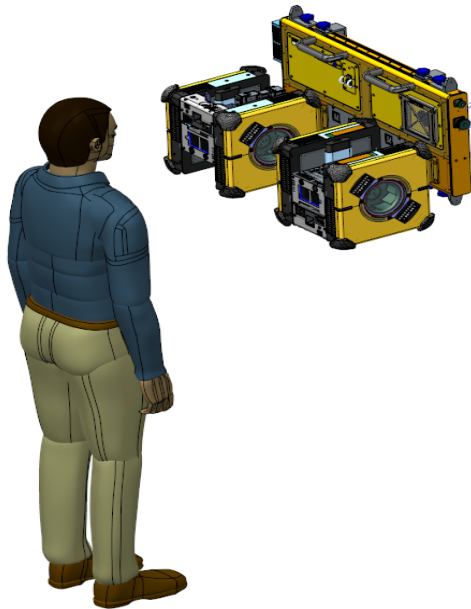
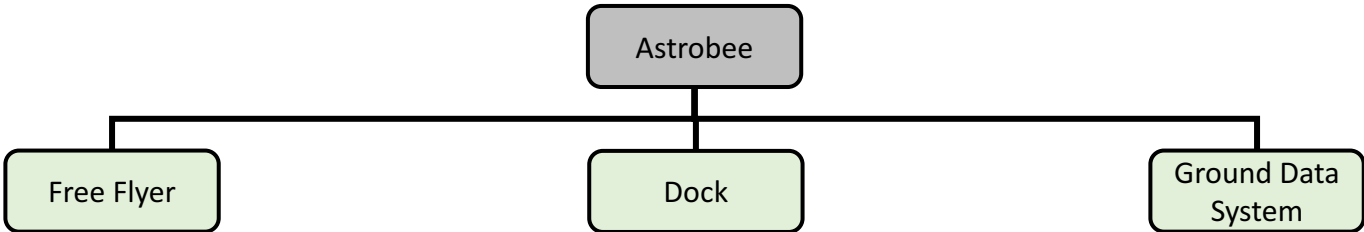


POIWG #41 Astrobee Splinter

April 25, 2017

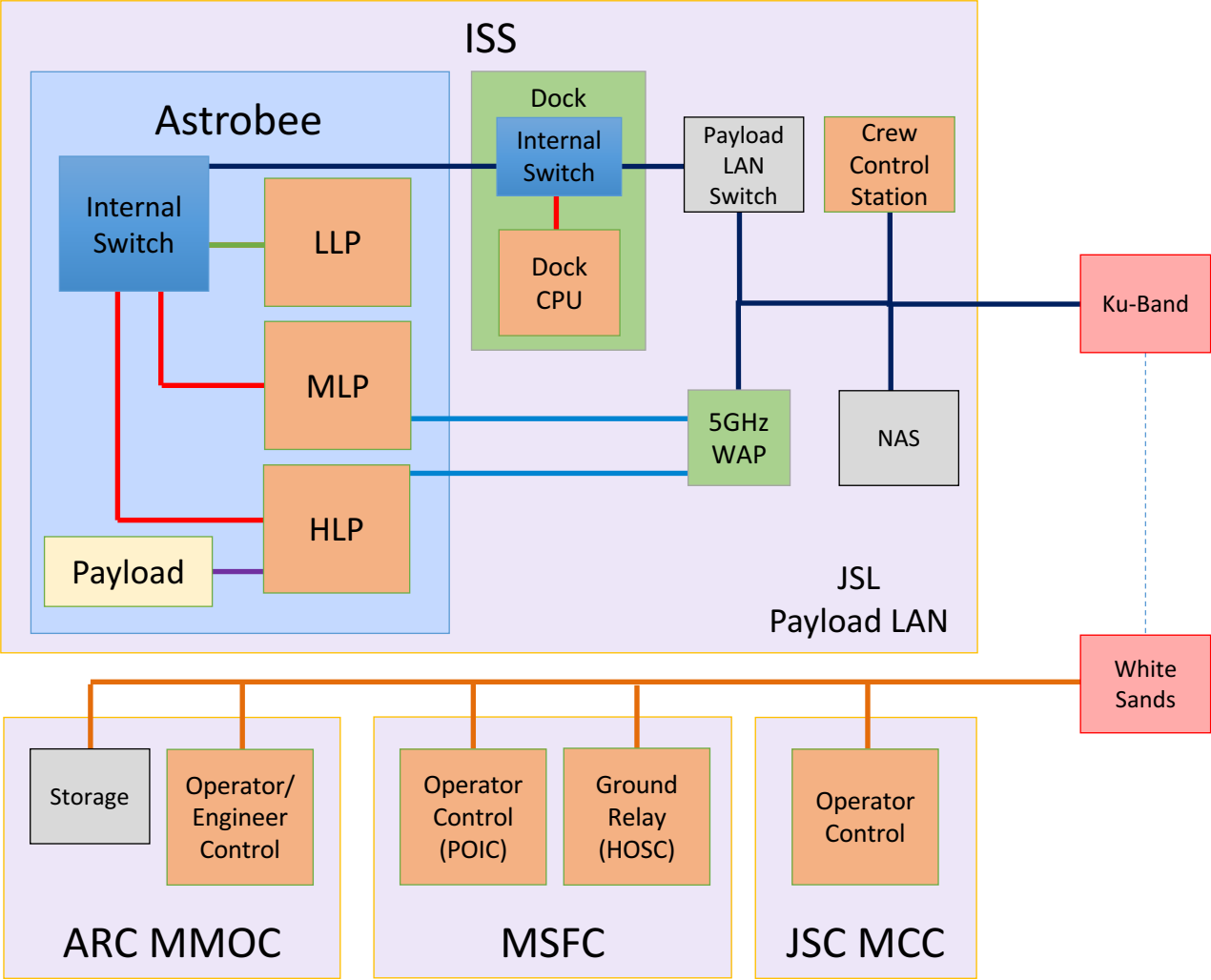


Astrobee Elements





System Data Flow Diagram



Link Legend

Ethernet/LAN

Ethernet:
Internal IP

Ethernet:
Internal and
Payload LAN

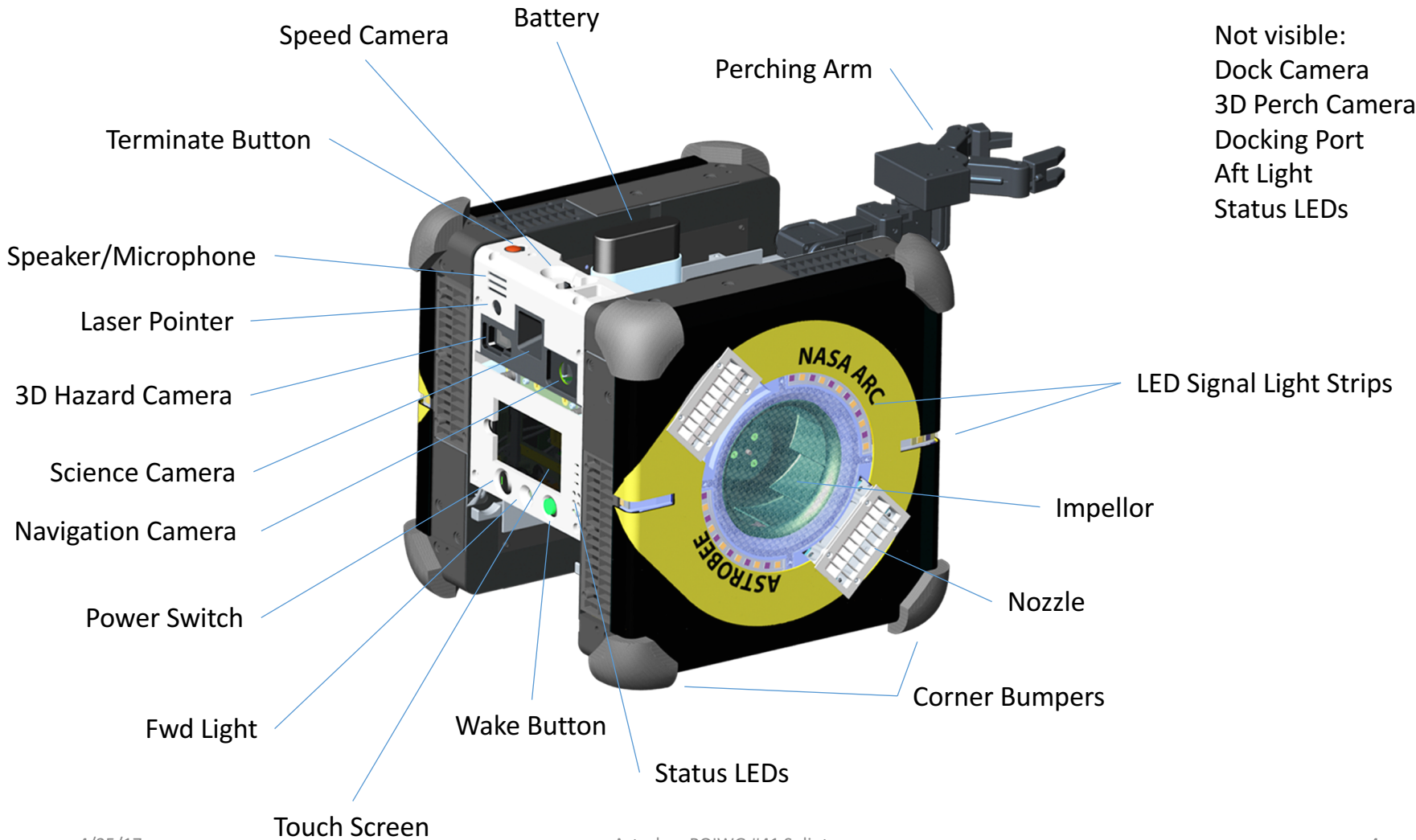
WiFi:
Payload LAN

USB

Other/LAN



Astrobee

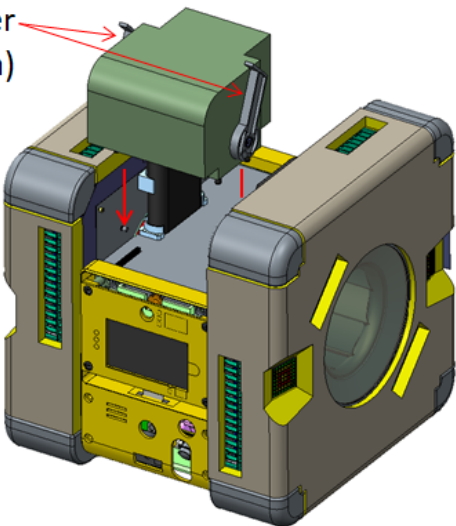




Payload Attachment Options

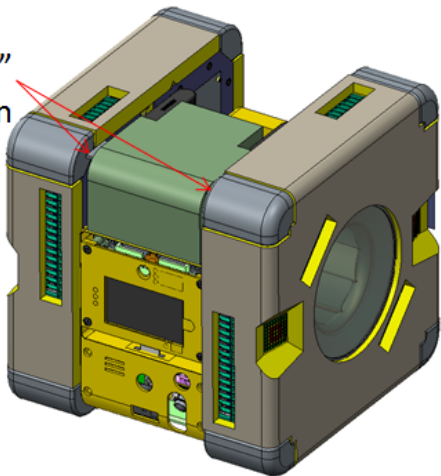
Quick “No Tool” Payload Attachment

2X Lever
(open position)



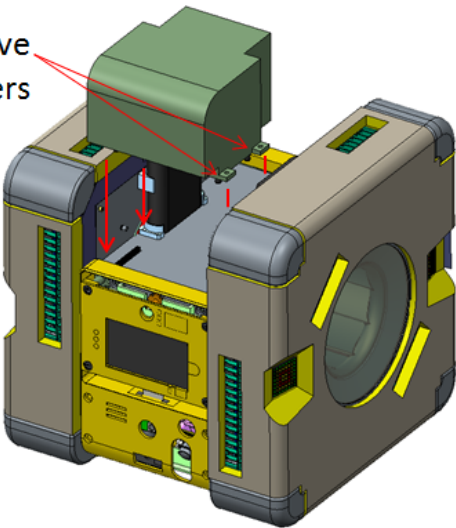
Lever engages and disengages payload connector and provides mechanical attachment

Lever in “Locked” position

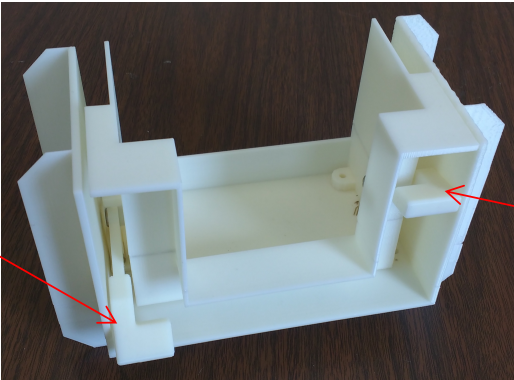


4X Fastener Payload Attachment

4X Captive Fasteners



“Un-Lock” Position

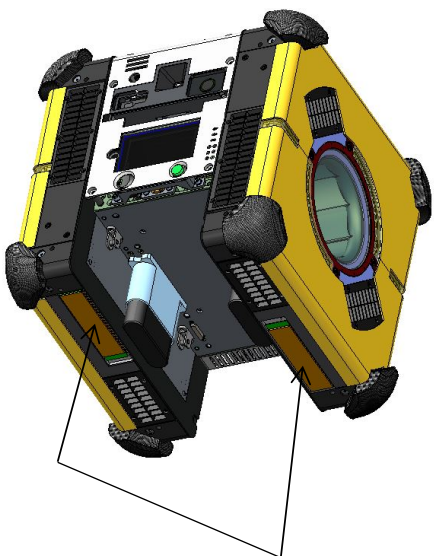


“Lock” Position

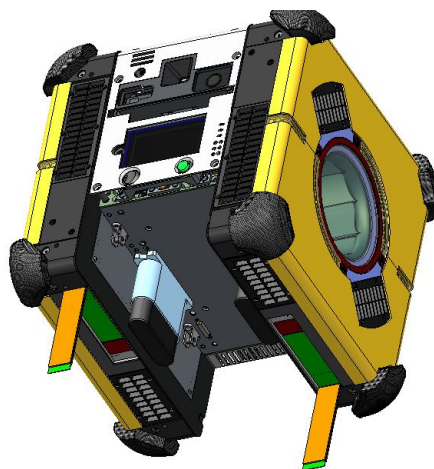


Restraint Straps

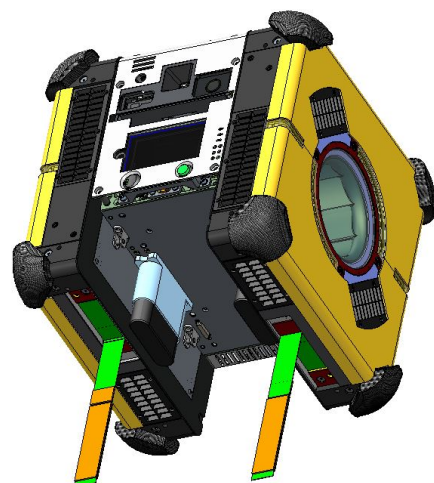
Strap with Velcro hook allows Astrobee to be restrained to ISS loop patches



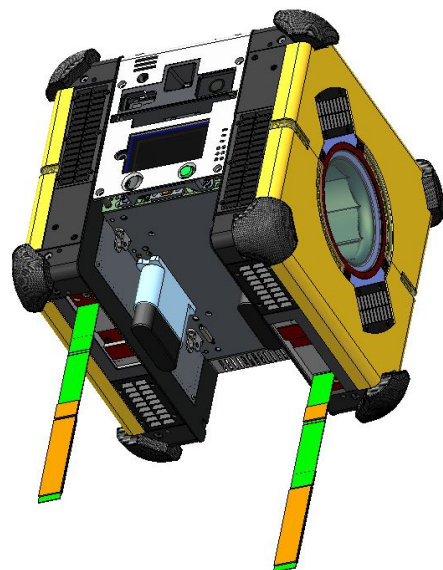
Two deployable straps
for restraining Astrobee on
station. Velcro Hook on ends of
straps



Strap is unfolded
1 fold



Strap is unfolded
2 folds



Fully Deployed
~ 10" Strap



Dock

Air Vent Deflector

Subsystem Breakers

Main Power Breaker

Cooling Fan

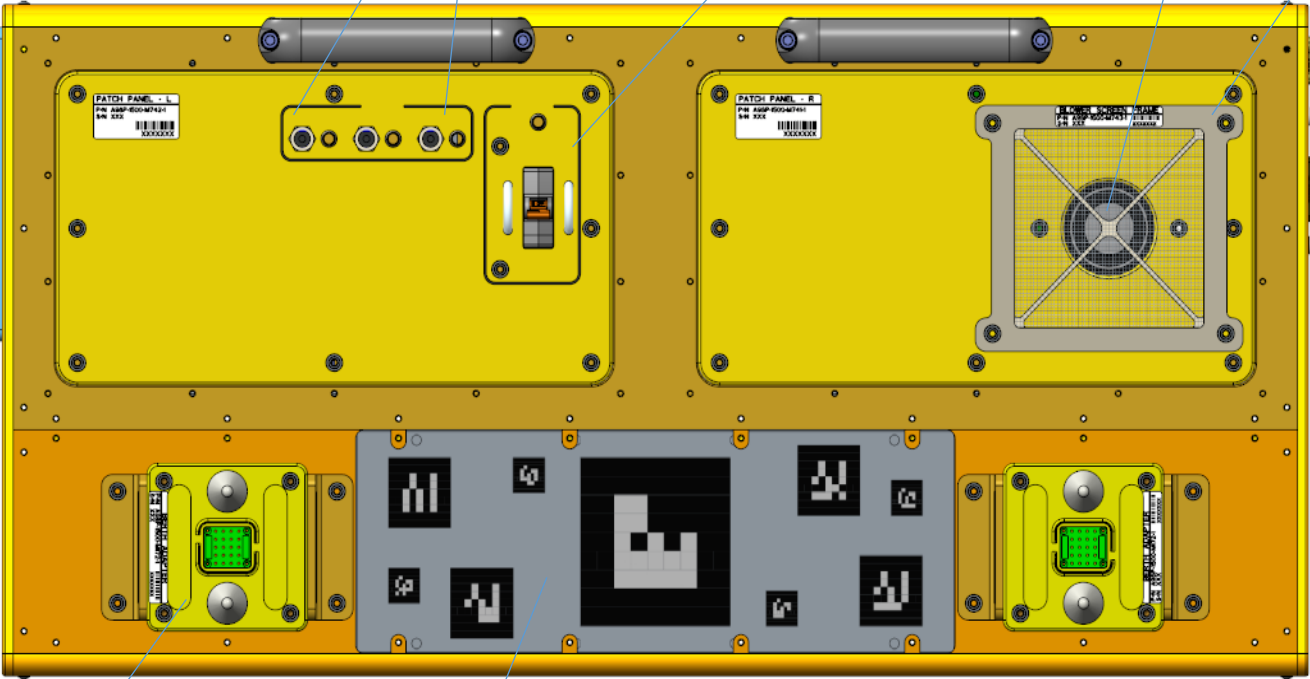
Cooling Fan Screen

RJ-45 Connector

Power Connector

Free Flyer Berth

AR Target





Run Plan Tab

File Edit View Help

Run Plan | Teleoperation | Guest Science

FreeFlyerA Comm ● Control DW@DW-Windows7-32 Batt 84 Docking Station ● GPS 11Jan17 18:20:23

Health and Status

Operating State	Plan Execution
Mobility State	Flying
Operating Limits	Default_Safeguard
Plan	ExamplePlan
Plan Status	Executing

Plan

Total Elapsed Time 00:00:43

Plan Step	Duration	Success
ExamplePlan		
0 Station		Complete
0-1 Segment	00:01:30	Complete
1 Station		Complete
1-2 Segment	00:01:30	Complete
2 Station		Complete
2-3 Segment		
3 Station		
3-4 Segment		
4 Station		
4-5 Segment		
5 Station		

Initialization

Wake

Grab Control

Robot Commanding

File ... C:\Users\DW\Desktop\FPla

Plan Valid

Load

Run

Pause

Skip Step

Description

A plan that goes in a spiral.

Live Telemetry | Live Images | Science Camera

Model of loaded plan

Monitor plan execution

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Teleoperation Tab

File Edit View Help

Run Plan Teleoperation Guest Science

FreeFlyerA Comm ● Control DW@DW-Windows7-32 Batt 87 Docking Station ● GPS 12Jan17 01:46:27

Health and Status Details

Operating State	Ready
Mobility State	Stopped
Operating Limits	Default_Safeguard
Plan	
Plan Status	Idle

Manual Commanding Perching Arm Docking

Initialization

Wake

Grab Control

No Bookmark Selected

Manual Inputs

m

Aft Fwd

Port Stbd

Ovhd Deck

deg

Roll

Pitch

Yaw

Reset Inputs

Options

Allow Lateral Motion

Override Obstacles

Override Keepouts

Commands

Move

Stop

Configurable Teleop Commands

Gripper Open

Idle Propulsion Idle

Payload A On

Flashlight Front Brightness High Set

Data Type Immediate Action Download Send

Live Telemetry Live Images Live Video

LAB1S1 LAB1S2 LAB1S3 LAB1S4 LAB1S5

LAB1D1 LAB1D2 LAB1D3 LAB1D4

Astrobee POIWG #41 Splinter

4/25/17

01:44:24 FreeFlyerA: Unknown Command Completed

Construct and send movement commands



Guest Science Tab

Crew Control Station

File Edit View Help

Run Plan Teleoperation Guest Science

Docking Station ● GPS 17Jan17 18:44:47

Astrobee Selection and Status

	Control	Batt	Summary	Plan	Plan Status	Health
<input type="checkbox"/> FreeFlyerA	nobody	85			Idle	●
<input checked="" type="checkbox"/> FreeFlyerB	DW@DW-Windows7-32	85			Idle	●
<input type="checkbox"/> FreeFlyerC						●

Checkboxes select Astrobees to command

Status summaries

Names of loaded Plans

Details

Commanding for FreeFlyerB

Wake Grab Control

Plans

Load

Run Stop

Manual Commanding

Guest Science Command

Send Command

4/25/17

18:41:36 FreeFlyerB: Grab Control

Live Telemetry Live Images Science Camera

Monitor Astrobee positions in 3D window

Astrobee POIWG #41 Splinter

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ISS Commissioning Activities

- Planned Activities:

- Installation
- Comm Checks
- Component Checkouts
- Initial Mapping
- Basic Mobility
- Autonomous Mobility
- Crew Interface Checkout
- Incremental Mapping – no crew needed
- Astrobee “B” and “C” Commissioning
- Demonstration – no crew needed other than payload installation in advance of demo



Initial Mapping Activity

- Example of an activity explicitly involving crew

Component Activities/Tests	Description
Setup	Astrobee engineering prepares free flyer for activity (wakes, initializes system, etc.)
AR Localization Test	Crew physically “flies” the robot around in the vicinity of the dock to test AR target localization
Crew mapping	Crew physically “flies” the robot around in the module containing the dock to collect initial map data
Shutdown	Astrobee engineering downlinks files and shuts down the free flyer



Autonomous Mobility Activity

- Example of an activity that does not explicitly involving crew for the entire duration

Component Activities/Tests	Description
Setup	Astrobee engineering prepares free flyer for activity (wakes, initializes system, etc.)
Demonstrate autonomous undock/dock	Crew manually places robot in 4 initial positions for docking tests
Demonstrate complex trajectory	Astrobee engineering commands the free flyer to fly one simple, one moderate, and one challenging trajectory
Demonstrate autonomous perching	Astrobee engineering commands the free flyer to fly to a perch location and perch
Demonstrate pan/tilt	Astrobee engineering commands the free flyer to pan and tilt while perched
Shutdown	Astrobee engineering returns the free flyer to the dock, downlinks files and shuts down the free flyer